Identity through alliances: the British chemical engineer

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Introduction

The development of a professional identity is particularly interesting for those occupations that have a troubled emergence. The hinterland between science and technology accommodates many such 'in-between' subjects, which appear to have distinct attributes [Johnston 1996, 1999]. Some of these specialisms disappear in the face of culturally stronger occupations. Others endure, their technical expertise becoming appropriated or mutated to serve the needs of different professional groups [Johnston 1996a].

This chapter is concerned with one extreme of these interstitial specialisms. Chemical engineering – a subject that by its very name is between the science of chemistry and the technology of engineering – did eventually become a profession, in at least some countries. It had a relatively easy time becoming established in America in the first third of this century [Noble 1977; Servos 1980; Furter 1982; Reynolds 1983, 1986]. On the other hand, chemical engineering remained largely unrecognised in Germany until the 1960s, and has attracted a smaller professional community there [Buchholz 1979; Schoenemann 1982]. In Britain, the chemical engineering profession has evinced distinct transitions over a period of a century. It emerged to become an influential contributor to western economies and one of the 'big four' engineering professions (along with civil, mechanical and electrical engineering) after the second world war, due in large part to the unmindful aid of an influential, if capricious, sponsor: the state. Yet chemical engineers had a long and troubled history of contestation with other professions [Divall 1996]. Because of this, the British case is particularly appropriate for examining the continual re-casting of the professional identity in response to external and internal pressures.

The dynamics of this profession, as for others discussed by Andrew Abbott, have been governed by jurisdictional disputes between occupational groups [Abbott 1988]. Inter-professional claims over professional tasks motivated and shaped subsequent organisational developments. Survival in the competitive system of professions was promoted by the particular tactics adopted by practitioners to strengthen their claims to authority. And the balance between professional existence and obscurity, in the British case, was decided largely by particular government policies. The findings reported here are one strand of a project to understand the historical evolution of a single technical profession in relationship to others. We will focus on the survival strategies of British chemical engineers, some key moments in their transition into 'professionals', and their continuing efforts to reposition themselves in an evolving ecology of professions.

Origins

The term ‘chemical engineer’ came into regular, if not common, use in the 1880s, when a few practitioners in Britain (and shortly after, in America) claimed it as the generic title for people like themselves – those competent in the design or operation of chemical plants on an industrial scale. Over the next three decades, however (that is, up to the first world war), they had little success in focusing any collective identity.

Chemical engineering emerged from a heterogeneous mix of workplace environments and occupations [Donnelly 1988]. From the beginning, jurisdiction over this occupation was contested from several others: the managers of chemical works, mechanical engineers, civil engineers and chemists working in industry. Even plumbers could argue that chemical plants were mostly about pipework and protective coatings. Academics and employers, too, wanted to take a hand in influencing the work and any representative bodies that might emerge.

This competition was complicated by the range of technical processes involved. In some sectors, manufacturing processes were at the forefront of chemical technology; in others, very traditional activities prevailed. And functional responsibilities could cut across industrial hierarchies. Thus the term ‘chemical workers’ included manual workmen, plant foremen, routine laboratory chemists and research chemists, through to plant managers with some responsibility for process control and perhaps design, to works managers and directors. This occupational structure differed from firm to firm and from industrial sub-sector to sub-sector. Finally, chemical engineering was by no means the only title in play. ‘Chemical technology’, ‘applied chemistry’ and ‘technical chemistry’ were all terms in common use. Courses under each of these names sprang up at polytechnics and universities. In these confused circumstances, it is not surprising that no significant attempts were made during the late nineteenth century to challenge the existing institutional jurisdiction over design and control work in the chemical industry.

The State as patron

By the second decade of the new century, five occupational institutions were vying to recruit recruit such workers. In addition to the relatively large Institute of Chemistry and Society of Chemical Industry were three others, all based on the discipline of chemistry.[1] But no single organisation – or named occupation – could claim undisputed jurisdiction over all aspects of the design and operation of chemical plants [Donnelly 1996]. This was the principal competition against which the would-be chemical engineers had to define their identity as a distinct professional group.

Yet the war temporarily transformed the prospects for the inchoate profession. In an industrial pool already super-saturated with attempts to

organise chemical practitioners, it catalysed professional crystallisation. New political structures, erected with great haste by the state to provide the explosives and other chemicals needed to wage the war, provided fresh opportunities for 'chemical engineers' and provoked them to organise and to make new claims to professional competency.

This altered situation began with the development of new industrial capacity. At the beginning of the war the British government was quite unprepared for the required scale of explosives production. There was little capacity to produce high explosives either by the national ordnance factories or by commercial firms. The government quickly recruited a variety of businessmen and technical experts to man an explosives committee [Moulton 1922; Lloyd George 1933]. Among the most important was the American manager of a South African explosives factory, Kenneth B. Quinan. Quinan (1878-1948) oversaw the construction of enormous state explosives factories across the country. The committee was soon incorporated within David Lloyd George's new Ministry of Munitions, which was to become the most pervasive and powerful government organisation in British history [Adams 1978, Wrigley 1982]. Almost incidentally during this unprecedented expansion of the chemical industry, the Ministry of Munitions helped to legitimise chemical engineers. It did this by creating a new technical problem (the need to rapidly scale-up technical plants and make them more efficient) and by providing an occupational environment in which solutions to these problems could be publicly demonstrated.

The so-called "chemists' war" eventually mobilised well over two thousand technical workers with chemical and engineering backgrounds. While Quinan's staff in the Ministry was populated with practically-trained engineers and administrators, the chemical factories were populated mainly with physical chemists. Many had been hastily withdrawn from military service or seconded from academic posts. The wartime identities of such people changed rapidly: their curriculum vitae show rapid advancement from 'trainee' or 'shift chemist' to 'chemist-in-charge', and then to 'plant designer' or Ministry Assistant, with a residency time in each post ranging from three to 24 months.[2] Such designers and operators were soon identified by senior officials within the Ministry as essential to its goals.

Quinan, shunning publicity, diffident about professional organisations and seldom employing the term 'chemical engineer' himself, nevertheless found his activities exploited by a handful of British chemical engineers to further their jurisdictional claims. The most influential protagonist was William Macnab (1858-1941), a senior war-time official in the Ministry and an authority on explosives. He purposefully portrayed Quinan and his techniques as a symbol of what was missing in the British chemical industry. After the war Macnab spread Quinan's methods to a much wider audience through technical studies of war-time manufacturing that he edited and that were published by the government. Postwar

educators saw them as up-to-date and exemplary texts on chemical engineering.

But the reports were intended to provide much more than illustrations of the value of chemical engineering expertise. The first of them sought to justify the Ministry's longer term goals in the light of its wartime accomplishments: the Ministry, claimed Macnab, could serve as a model for the postwar chemical industry [Macnab 1920]. By advocating the reconfiguration of what were characterised as the traditionally distant relationships between academia and industry, 'chemical engineers' were offered an opportunity to colonise territory in both sectors and stake out new ground for their embryonic profession. The reports drew heavily upon a technocratic rhetoric, of 'scientific control' replacing 'the old rule-of-thumb practice', a discourse with deep resonances at that time with many other areas of industrial and political life. While not picking out chemical engineering as a distinct discipline, the government did provide opportunities for its protagonists. Lloyd George, for example, described the Ministry's melding of industry, labour and 'science' as one of the state's most important accomplishments. Chief among the mechanisms had been encouragement for the formation of representative bodies. Similarly, professional associations expanded amongst scientists, educators, and civil servants: the war dissolved many traditional occupational boundaries and enabled a greater degree of collective action [MacLeod 1976].

Other initiatives by the state, even if not intended primarily to serve the interests of would-be chemical engineers, provided an organisational structure for the chemical industry into which new bodies representing them, or their allies, could fit. The Ministry had brought together practitioners from disparate backgrounds; allowed them to share knowledge that previously had often been narrowly specialised, secretive or incomplete; dramatically and rapidly increased the scale of British chemical plant and manufacturing; fostered a new relationship between industry, government and labour; and identified the need for more 'chemical engineers' trained along academic lines. Perhaps most importantly, it released these officially legitimated practitioners at the end of the war to fend for themselves.

Postwar organisations representing chemical engineers

The immediate postwar climate engendered by the successes of the Ministry of Munitions infused the campaigners for new organisations of 'chemical engineers'. It had vaunted a new concept that spanned political beliefs: that the economy should be organised on a corporate basis, with new chemical engineering institutions acting as intermediaries between government and interest groups in the chemical and related industries. Thus the 'hybrid' nature of this technical subject seemed to make it ideal for

a political role as well. The organisers of these new bodies emphasised social community, national objectives and collective organisation.

In the last months of the war, a group devoted to chemical engineering as an occupational specialism was organised within the Society of Chemical Industry. The stated purpose of this Chemical Engineering Group (CEG) was to promote chemical engineering research and the education of chemical engineers. By articulating and spreading a body of specialist, codified knowledge, the nascent profession laid claim to authority over fields of technical expertise traditionally filled by chemists, or mechanical engineers. Only a handful of mainly part-time, non-degree courses in chemical engineering were available in the late 1910s and early 1920s. While it was successful in focusing interest and promoting the technical aspects of chemical engineering through its activities as a learned society, the organisation was prevented by the SCI's constitution from accrediting engineers. The Group was thus prevented from anchoring the occupational tasks it studied to a distinctive type of professional organisation.

From the start, a number of members agitated for a separate institution specifically to recognise chemical engineers as professionals. Many of them wanted to build an alliance across traditional occupational categories. The half-dozen chief organisers of what was to become the Institution of Chemical Engineers (IChemE) were prominent in at least three organisations linking government, industry and would-be professional engineers. But the early membership comprised a bewildering variety of occupations. This was matched by heterogeneous professional aims, both in terms of scale and execution. For a small but active minority of the organisers of the Chemical Engineering Group and, later, the IChemE, the prevailing theme was 'organisation to boost national fortunes'. They saw the professional development of chemical engineers as a crucial step in making British industry efficient and internationally competitive. By contrast, most of the IChemE's 'supporters of formation' had more limited aspirations, typically listing the importance of a professional qualification as recognition of experience, or the need to improve and regularise standards of training. The first group was thus sympathetic to the postwar government aims and sensitive to external economic threats; the second, to the more local problems of professional rivalry over jurisdiction. The leaders said they wanted a strong national industry; the majority simply wanted recognised jobs within it.

As something akin to a learned society, the Group throughout the 1920s encouraged the development, distillation and dissemination by and among practitioners of the codified knowledge necessary to stake a claim for chemical engineering as a specialist technical occupation; the IChemE strove to build recognition among employers and others for the formal professional qualifications – based partly upon this body of practitioners' knowledge and partly on the work of academics – that it quickly established

to ground the jurisdictional claims of chemical engineers as professionals [Divall, 1994]. But the lack of a clear consensus over the identity and desirability of the 'professional chemical engineer' – even among those who were ostensibly in favour of the project – was evident in the rapid loss of enthusiasm among such organisations for active support of the IChemE.

The strength of the established professional jurisdictions undoubtedly had much to do with this. The organising committee of the IChemE quickly identified its main task as fitting into the existing complex system of professional bodies. Eleven other scientific and engineering societies were consulted, including the Institute of Chemistry and the American Institute of Chemical Engineers (AIChE), which had formed in 1908. Only the Institute of Chemistry met with them. Despite some attempts to legitimise the British profession by characterising its American counterpart, the AIChE, as a model of success, contact between the two bodies remained limited, if amicable.

This lack of concern from most of the other professional bodies is not surprising. Although in retrospect we can seen how chemical engineers threatened to perturb existing professional arrangements, British technical societies were adept at neutralising the threat posed by newcomers by permitting the foundation of a specialist body that then had to take a lowly place in the professional hierarchy [Buchanan, 1988].[3] Strong objections to the founding of a new institution were likely only if the newcomer's claims to jurisdictional authority trespassed too far onto the central domain of an established institution, or if they involved a marginal field acknowledged to be of strategic interest. These cases cover the objections to the founding of the IChemE. The Institutions of Civil and of Mechanical Engineers, for example, were in little doubt that 'chemical engineers' should be resisted if they claimed a competence in the design and construction of chemical plant; this field was regarded unequivocally as their responsibility. And the Institute of Chemistry was concerned about its own weak jurisdiction over the chemical industry [Watson 1976].

Defining the chemical engineer

Such key organisational and political transitions created a professional identity for chemical engineers. But through the interwar period, that identity was also shaped very much by different audiences in industry and academe. For industrialists – as for the state – chemical engineers were made more visible by accentuating how they could improve production economics. The first secretary of the IChemE, for example, identified the chemical engineer as 'the man whose job it is to raise the efficiency of chemical plants', and claimed that a doubling of plant output would be possible 'if there were complete control by competent chemical engineers' [Hinchley 1921]. Similar claims were made throughout the 1920s by firms manufacturing chemical plants. A flurry of advertisements vaunted

economy and profit as the prime justification for chemical engineers, giving them a public profile for the first time.

For practitioners themselves, professional definition reduced to the set of educational qualifications and experience necessary for membership in the Institution of Chemical Engineers. And beyond these lay definitions of the scope of the discipline, which became increasingly painstaking and contentious in the handful of university programmes that struggled to expand between the wars. Such programmes grew out of applied chemistry or engineering departments, from specialisms such as gas and oil engineering, and sugar chemistry. Their success revolved around the ability to break down a process into a number of general steps that became known as 'unit operations' [Divall & Johnston, 1998].

The only power directly under the control of the IChemE leadership was the selection of suitable members. The early Institution saw membership selection as a powerful means of raising the standard of chemical engineering practice – what could be called 'occupational eugenics' to breed an improved strain of specialist. Through its membership policy, it could filter and prune the available pool of ostensible 'chemical engineers' into a membership and profession of its own making. More positively, it could actively mould the skills of its younger membership by an explicit educational policy for training the next generation of chemical engineers.

Despite such potential power, the Institution admissions committee had to tread a narrow line. Standards of qualification that were too harsh would create an elite profession, but one that was too small in numbers to become visible and effectively populate industry. Too lax a policy would swell the ranks of professional chemical engineers at the expense of the reputation of the profession. Either extreme would result in failure of the profession to become viable.

During the first decade of the Institution it attempted to set admissions standards and a syllabus for training. Little consensus could be found amongst employers. The largest firms were dismissive of the need for such a hybrid. Some, by contrast, wanted a thorough grounding in physical chemistry, physics or metallurgy. Yet others thought that any four-year course would be inadequate to supply enough chemistry, physics and engineering knowledge, as opposed to those who stressed the necessity of long periods of works experience before, during or after college.

Interwar decline

Competition for professional 'space' in industry and academe demanded the weapons of public recognition and certified status. But while recognition seemed assured in the immediate postwar years, the support of

government in fostering educational programmes, and of industry in employing chemical engineers, proved difficult to sustain between the world wars. One President recalled that the early IChemE was received with 'suspicious glances of other members of the engineering fraternity. . . feeble jokes of some industrialists and . . . almost complete indifference of our universities' [Cremer 1950]. Without the legitimation of influential sponsors, 'chemical engineers' could not effectively press their claims to professional status.

Chemical engineers found that the postwar economic instability opened opportunities but just as quickly closed them off. The IChemE was founded in a volatile economic and political climate, with no fewer than four Prime Ministers and three governing parties during its first three years. Despite these economic and political swings, the state continued to promote the consolidation and rationalisation of chemical manufacturing, culminating in the creation of Imperial Chemical Industries (ICI) in 1926. The new company controlled a third of chemical production in Britain. Further rationalisation of the chemical industry was much discussed during the early years of the slump of the late 1920s and early 1930s.

The claims made for the managerial expertise of chemical engineers suggest that they hoped to find senior places in the hierarchies of the new, much larger companies. But any such expectations were quickly dashed. Although some big firms were pleased to employ chemical engineers, in others the rejection was almost total. Between the wars, many did not see any need to employ a specially trained 'chemical engineer' when the combination of two people – an industrial chemist with a mechanical engineer – was thought to be better. According to the Appointments Bureau set up by the IChemE, the profile of available chemical engineers seemed to be a chronically poor match for employers' expectations. Employers too often required unique experience or exceptional training. In particular, chemists and mechanical engineers proved adept at monopolising positions of any seniority in ICI. On the whole, the failure of chemical engineers to make significant inroads into the management and even the more lowly of technical posts in big chemical manufacturers meant that they were restricted to small businesses. Here their talents were commonly perceived more in terms of being cheap jacks-of-all-trades than the industrial leaders envisaged by some among the IChemE's promoters.

The IChemE's council recognised, however, that competition by chemical engineers for social and economic authority did not take place at worksites as much as within those organisations, such as universities, that legitimate their jurisdictional claims; As Abbott has observed, boundaries between engineering professions tend to disappear at places of work. The Institution therefore spent most of its energy in developing educational programmes between the war. Thus direct confrontations between the expectations of the IChemE and those of industrialists were limited and

downplayed. It was a safer policy to plan academic syllabi that in the long term might create an industrial demand for chemical engineers. In this way, the issue of recognition in the workplace was largely sidelined for the more easily addressed problem of recognition in academe.

Effects of the second world war

A coherent and stable identity for chemical engineers could not be pressed without solid industrial or government support, both of which were absent during the depression of the early 1930s. However, the likelihood of war provided unique opportunities for the Institution to press its claims and negotiate recognition. For the first time since 1918, the IChemE was able to evoke the perception that the proficiency of chemical engineers was important – even crucial – for production in an environment of increasingly limited national resources. And unlike the interwar period, when money was short, the state during the war lubricated the economy from its monetary reserves. In this context of limited resources but abundant national determination, chemical engineers could advance their self-portrayal as essential engineers of economy. If the occupational status for IChemE members often proved prosaic, the preparations and, later, waging of war provided occasions for successes for the nascent profession.

In 1936, the Committee of Imperial Defence at Whitehall began taking an interest specifically in the availability of chemical engineers in Britain. The President of the IChemE wrote a memorandum to the Committee drawing upon 'the lessons of the great war' which demonstrated 'an immediate need for soundly-trained chemical engineers' [Levinstein 1936]. For him, the coming war offered an opportunity to press educational programmes and assure full employment of his members. The Honorary Secretary made clear his own vision of a hierarchy of relevant professions: he appended a paragraph pointing out that 'the large number of chemists engaged in teaching' should be considered 'a potential source of men suitable for employment in minor chemical engineering positions' provided they were given vacation training. Chemists, and particularly those without industrial experience, were to be considered only as a last resort. For him, the coming war signalled the chance to press jurisdictional authority with an attentive sponsor. Thus conflict over the role of chemists and chemical engineers in industry was brought to government attention for the first time.

In the summer of 1938, when the Ministry of Labour sent a request to British engineering institutions to survey their members 'in case of national emergency'. This channelling of patriotic enthusiasm soon foundered on details, however. According to the Ministry's classification scheme, chemical engineers were to be categorised as 'a rather secondary variety of industrial chemist', complained the Secretary – not as engineers. While the government continued to neglect chemical engineers, other professions did not hesitate to usurp the occupational niche they had

staked out. The Institution of Mechanical Engineers instructed its members that those engaged in the design and construction of chemical plant should be classified as a category under mechanical engineering. Nevertheless, the 'Mechanicals' gave their support for a definition of chemical engineers as a distinct engineering profession. The IChemE began to identify chemistry alliances as dangerous and engineering liaisons as serviceable, perhaps because of the preponderance of engineering-minded designers and consultants over academics in Council. This courting of new patrons was successful: the IChemE succeeded in having the Registry classification amended, a re-categorisation that was trumpeted as a victory for the profession. The grudging official acceptance was nonetheless in marked contrast to events in America, where the government had accepted chemical engineering as a distinct specialisation without debate.

Postwar expansion

Immediately after the second world war, Britain, and its chemical engineers, had mixed prospects. New industries promised a rapid expansion, but the available chemical engineers were too few to do the job. The wartime growth of the petrochemicals industry – which was manufacturing chemicals from a new raw material, petroleum, instead of the traditional and more expensive coal – demanded technical workers. So too did entirely new production processes such as synthetic fibres and biochemicals. For the first time, there was room for new technical professionals in an under-manned economy. Petitions by manufacturers' organisations and the IChemE alike prompted the Ministry of Education to set up a variety of training courses in chemical engineering at polytechnics and universities. Thus sympathetic trade organisations, combined with a government desperate to boost exports and to maintain an international influence, again became effective sponsors of the profession. As a result of new training programmes, the number of chemical engineers trained went from a couple of dozen per year before the war to several hundred per year by the mid 1950s.

But after the second world war, the profession of chemical engineering was not only on the ascendant; it was also vigorously colonising new specialisms. Nuclear engineering is a cogent example of this vitality. For chemical engineers, the burgeoning nuclear programme had many similarities with the munitions programme during World War I. Both were copiously funded and controlled by the government. And both, initially, employed few recognised chemical engineers. The Atomic establishments were initially staffed with many ex-employees of ICI who had managed chemicals factories during the second world war. Many of the atomic factories were set up at ordnance factories, sometimes before the old staff were even replaced. There was therefore a very real continuity of purpose, occupational profile and institutional culture. Because of this, some within the Institution of Chemical Engineers

attempted early on to cite the connection between the processes used in the nuclear industry – chemical separation, handling, corrosion prevention, thermodynamic calculations – and the expertise of chemical engineers. They sought to extend their jurisdiction to this new domain of nuclear engineering. The President in the early 1950s suggested that the older specialisms were threatened by the new profession: 'with the lure of nuclear physics and electronics, classical physicists were a dying race', he said, and 'chemical engineers had to do the research' [Hartley 1953].

The IChemE continued to identify itself with other engineering professions instead of with chemical organisations. That year, at the invitation from the Civils, Mechanicals, Electricals and the Institute of Physics, the IChemE collaborated to form a joint body for the advancement of nuclear technology. And chemical engineers did manage to insinuate themselves in the new working environments, too. Over a hundred chemical engineers were at the UK Atomic Energy Authority (UKAEA) by 1956, and a 1958 survey found more IChemE members to be working in the nuclear industry than in either the plastics, dyes or food industries. Recruitment brochures from the government-owned facilities began to highlight opportunities specifically for chemical engineers. By the early sixties, the UKAEA was second only to ICI in its employment of chemical engineers.

The new occupational pattern also reflected a new balance of power with other professional groups. The formation of a separate and unaffiliated Institution of Nuclear Engineers in 1958 provoked the IChemE to pronounce that 'the new industry did not bring into being a new kind of engineer, but was a new challenge in the application of existing branches of engineering', an ironic echo of the criticisms voiced by other institutions at its own formation in 1922. This attempt by the IChemE to expand its borders to include the nuclear engineer was supported by the head of the atomic factories programme, Sir Christopher Hinton (1901-1983), who joined the IChemE and promoted nuclear engineering as the 'natural' constituency of chemical engineers. Thus the weight of the Atomic Energy Authority supported a new identity for the chemical engineer: not as a specialist in engineering economy, or a species of chemist, or a 'hybrid' engineer, but as a sort of renaissance man having a competency ideally tailored for the nuclear industry.

Nuclear engineering was not a unique case of professional colonisation; other subjects were similarly claimed. The IChemE President in 1955 argued that mineral engineering, with its processes of ore treatment and extractive metallurgy, intimately involved chemical engineering techniques. Yet other subjects were portrayed as 'naturally' ceding to chemical engineers owing to their emphasis on 'processes'. The influx of chemical engineers into environmental engineering, for example, seems to have occurred without significant contestation of territory [Schmidtke 1982].

Consolidating definitions

By the end of the 1950s such territorial renegotiation had had a mixed reception. A 1960 editorial in Chemistry and Industry criticised chemical engineering as a 'diffuse' discipline still 'in the hands of the chemist and thermodynamicist' and for not having more actively colonised engineering as a cognate specialism. Nevertheless, having found more regular government support through educational programmes and state-sponsored industries, the profession was on firmer footing.

Increasing international competition convinced large firms such as ICI to change employment categories. Prior to 1958, only 10 chemical engineers had been taken on at one ICI site, but by 1964 a total of 100 chemical engineers were employed, many replacing chemists [Reynolds 1965]. The position of the chemical engineering profession with respect to the three largest bodies – Mechanical, Civil and Electrical – became more established when the government in the mid 1960s sought to regulate the engineering professions. A new Council of Engineering Institutions (CEI), in which the IChemE strove to play a highly visible role, regularised training standards and professional conduct for the established professions.

Nevertheless, chemical engineers did not find long-term stability in their occupation despite professional recognition and 'official' sponsorship of this kind. The early and mid 1970s were difficult times for the chemical industry and the Institution. The plant industry was in recession owing to world-wide overproduction of chemicals. New chemical engineering processes were no longer appearing at the same heady pace as during the 1950s. The consequent lack of demand for engineers following this boom was exacerbated by two other factors. First, the price increases and embargo of the Organisation of Petroleum Exporting Countries in 1973-74 led to a general energy crisis in Britain and other western countries. More directly, the chemical plant explosion at Flixborough in 1974 damaged the reputation of chemical engineers and the chemical industry as much as previous concerns over environmental pollution had done.

Some observers presented this crisis for the profession positively, as a means of entering new disciplinary territory; others saw the new decade as heralding the end of a temporary and market-driven profession. While chemical engineers may have been valuable in increasing the efficiency of processes in industries built by loose collaborations of chemists and mechanical engineers, went the argument, declining industries no longer needed as many engineers as the academic world produced.

Such mixed opportunities and lack of consensus have extended to the present day. The chemical engineering profession was gradually moving away from the chemical industry, but still staked its claim on influencing the process dimension of many other industries. The

professional environment in Britain was complicated by a new series of government interactions aimed at restructuring the technical professions and the CEI: the Finniston report on the engineering professions in 1980, leading to the Engineering Council (1982) and the Fairclough proposals for its extension in the early 1990s [Jordan 1992]. They sought to reduce the number of engineering institutions by encouraging mergers. The possibility of changing the name of the Institution of Chemical Engineers to 'Process Engineers' was mooted in the 1980s. The Institution considered, but ultimately rejected, mergers with the Society of Chemical Industry, Institute of Energy, Institutions of Production Engineers and Plant Engineers, and others. Despite its continued independence in the plethora of chartered engineering institutions and bodies for technician engineers and engineering technicians, admitted its President in the mid 1980s, 'the IChemE is but one cog' [Beveridge 1985].

Conclusions: boundary disputes and sponsorship

Establishing a 'space' in the ecology of professions had been the long-standing concern of British chemical engineers. The tactics of their Institution varied with time and circumstance. But in the peculiarly British context of the engineering professions, the catalysing events centred around wars and their aftermaths. During and after the first world war, chemical engineers were singled out and imbued with qualities closely linked to the political mood and national recovery, as 'engineers of efficiency' or as 'industrial managers'. Between the wars, they reverted, though, to an unattractive species of hybrid chemist. After the second world war, they were again portrayed as a crucial specialism for international competition, again from an economic and military perspective, but this time as a scientifically-based generalist or unifying profession. While this crucial government support for the profession was transitory, it permitted protagonists to use their advantage to first insinuate themselves among established professions and then to dominate some of the new sub-professions that appeared after the second world war. Alliances with engineering, rather than scientific, specialists proved more workable in the long run, although the IChemE courted bodies in both domains at various periods. The irony for chemical engineers is that, while the chameleon-like strategy of adapting identity has helped them survive, they remain perhaps the least identifiable of the technical professions.

From this particular historical case study come some general conclusions relevant to British technological professions, and arguably to professions as a whole. First, the assumption of the 'homogeneity' of the profession is largely a mirage. While there was unquestionably a marshalling of the members and leadership against 'external' threats, it remains true that the adminstrators were drawn from factions that had goals as distinct as business promotion and government co-operation, and that the rank and file membership had distinct sets of professional

motivations. Second, the establishment and maintenance of professional jurisdiction for this ‘profession of capital’ demanded continual and energetic efforts on the part of its representative institution. And third, alliances and patronage can play a vital role for an emerging profession. Studying the sponsors, accomplices and adversaries can therefore reveal much about the profession itself.

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Notes

1. The Association of Chemical Technologists (1911), becoming the Institution of Chemical Technologists (1914); British Association of Chemists (1917); National Association of Industrial Chemists (1917).
2. Application forms for the Institution of Chemical Engineers, Rugby, UK.
3. The Institution of Mining and Metallurgy, for example, had obtained a Royal Charter in 1915, and the Institutions of Gas Engineers and of Mechanical Engineers were then seeking one.

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